

# Using Lesson Study and Four-Column Lesson Planning with Preservice Teachers

*Incorporating four-column lesson planning into lesson study encourages preservice secondary school teachers to be more student centered and value collaboration.*

Michael E. Matthews, Christopher S. Hlas, and Teresa M. Finken

**L**esson study, a form of professional development that originated in Japan, is gaining popularity in the United States. In lesson study, a small group of teachers (referred to in this article as a lesson study pod) collaboratively designs a model lesson to address specific goals. The lesson is taught by one of the pod's teachers, while the others observe the students and the lesson without intervening. The purpose of the observations is not to assess the teacher but rather to assess whether the lesson design addresses the identified goals. A postlesson debriefing may provide insights that lead to lesson revisions. The revised lesson may be taught by a different teacher, while the other teachers in the pod observe. The cycle continues for as long as the pod determines that revisions are necessary. Once a lesson study cycle is completed, reflections and other insights are disseminated to pod members and others via reports, Web sites, training, and other means.







The lesson study cycle described here is typical in the United States and closely mimics the Japanese cycle. One aspect of lesson study that is commonly overlooked, however, is the instrument used for creating the lessons—the four-column lesson plan.

### WHAT IS A FOUR-COLUMN LESSON PLAN?

Traditional lesson-plan formats in the United States consist of one column; they are sequential and focus on the teacher's actions for the lesson. Four-column formats use both vertical and horizontal dimensions. Items are arranged vertically in sequential order and are synchronized horizontally (Lewis 2002). Developing a four-column plan requires predicting student responses, preparing appropriate teacher responses (such as further

questioning, differentiation, and scaffolding), and assessing students' understanding. Four-column lesson plans are organized horizontally by these topics: procedures, student responses, teacher responses, and evaluation and assessment.

**Table 1** shows a portion of a sample four-column lesson plan. In the first column, the teacher lists the traditional sequence of activities, along with preplanned questions. The potential responses to these questions are noted in the second column, near the corresponding activities. In the third column, the teacher suggests ways in which he or she could respond to the students' reactions and interactions with the mathematics. The fourth column is reserved for the teacher's informal and on-going assessment of students' understanding.

**Table 1 A Preservice Teacher's Four-Column Lesson Plan**

**Overall goal: To formulate a conjecture for the volume formula for pyramids and cones from the formula of prisms and cylinders**

**Materials needed: Beans, hollow shapes**

Steps of the Lesson: Learning Activities and Key Questions	Expected Student Reactions or Responses	Teacher's Response to Student Reactions/ Things to Remember	Goals and Method(s) of Evaluation
Review volume of prisms/cylinders (recently learned).	Some students say " $L \times W \times H$ " instead of " $\text{Base Area} \times H$ ."	Present cylinder as a counterexample.	All students show that $V = \text{Base Area} \times H$ .
Show a right prism and right pyramid w/ same height and congruent bases. "How many times bigger is the volume of the prism?"	Likely guesses include 2 times bigger. Some students may correctly guess 3.	Encourage guesses/ explanations.	Visually check that each student is making a conjecture and trying to think why.
Students explore (using beans and hollow shapes, including oblique shapes) and record answers on the board.	Beans are not precise (e.g., 43 beans compared to 15 beans may not seem to be "3" times as big).	Discuss possible refining of the answer if a better unit (say # of grains of sand) had been used.	Students should recognize that the volume of the prism is about 3 times the volume of the pyramid.
If the volume of a prism is represented $V_1 = Bh$ , how can we represent the volume ( $V_2$ ) of a pyramid?	Some may think that $V_2 = 3Bh$ .  Others will see the correct solution.  "2" thinkers may be confused why it isn't 2 times as big.  Some students want a more thorough proof.	Pyramids have more volume than a prism?  How might a cone be related to a cylinder?  Showing the triangular prism that actually is twice as big can help.  You may choose to do a rigorous (based on a limit approach) proof or just provide a reference. ( <a href="http://mathforum.org/library/drmath/view/55041.html">mathforum.org/library/drmath/view/55041.html</a> )	All students should believe the $V_2 = (1/3)Bh$ formula. Ideally all students will apply the formula to cone/pyramid volume problems.

## USING FOUR-COLUMN PLANS TO ENHANCE LESSON STUDY

One advantage of the lesson study model for professional development is that it can help teachers become more adept at predicting and hence supporting student reasoning. The four-column plan for lesson study provides a prescribed format in which participants can anticipate student reactions before implementing the lesson. Moreover, this format allows participants to consider the teacher's responses to these student reactions. To be successful, lesson planners must anticipate how students are interpreting and using the lesson content through their reasoning. Columns two, three, and four enable observers to focus on how students react with the lesson, and column four also allows for a variety of assessments to inform the pace and orchestration of the lesson. Once the lesson is planned and the observations begin, teachers gain insight from seeing student reactions and evaluating their own anticipated responses and assessments.

### PRESERVICE TEACHERS' INSIGHTS

For the last few years, we have been using lesson study and four-column lesson plans with preservice teachers as part of their initial professional development. Using the Fernandez (2005) adaptation, which streamlined the lesson study format for methods courses, preservice teachers develop goals-driven lessons, use peer observation for the lesson evaluation, and conduct postlesson debriefings, which lead to informed revisions. In a similar lesson study adaptation, we incorporated cooperatively written four-column lesson plans as part of the practicum and methods course content for these preservice teachers.

To examine the possible impact of our lesson study adaptation, we analyzed surveys conducted at the end of the course, follow-up surveys conducted six months later, comments from the preservice teachers' student teaching supervisor, and the preservice teachers' journal entries from the methods course. To analyze the data, we used qualitative methods, scouring the data for consistent themes that appeared in multiple data sources (triangularization). In this article, we focus on findings about two of these themes: student-centered learning and the usefulness of peer collaboration. Because qualitative research does not contrast findings against a control group, these results should be considered suggestive, not causal.

The preservice teachers reported that the four-column planning and lesson study helped them become more student centered in their approach to teaching, planning, and reflection. One teacher stated, "Really trying to think from a student's perspective instead of always thinking about what,

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as a teacher, I'm going to be teaching [was my most intense experience]. I really thought it was beneficial to think how the students would react and to think of their activities. What will they be doing?" Another teacher commented on the four-column plan, particularly the second and third columns: "I really like this section, because it gets you to start thinking about how students will be thinking in the classroom. Even if you are completely off in your predictions of their thinking, it still helps prepare you for what might happen." This teacher, like many others in our study, went beyond simple appreciation of the focus on students to the recognition that this focus was the reason that the four-column plan helped the pod's lesson planners and teachers be more prepared. A third teacher discussed the potential contrast between using traditional and four-column plans in future teaching, noting, "I'm not sure that my practice would be that different, because either way I'll still be thinking ultimately about the students—but with a four column plan, things might be smoother because student responses are recorded and anticipated."

Many of the preservice teachers in our study recognized that devising four-column plans requires additional time in their daily planning for lesson study. However, most indicated that, as the third teacher quoted earlier implied, they will continue to be student centered in their future activities as teachers.

The preservice teachers in our study also found that the lesson study process helped them recognize the value of collaboration and become more collaborative in their planning and reflection. One teacher, when asked how the lesson study experience would influence his or her short- and long-range planning, said, "Lesson study has made me realize how important it is to reflect on lessons and talk them over with other teachers." Collaboration was also deemed useful during the planning stages:

# Lesson study and the four-column format may have helped these preservice teachers by encouraging and focusing their collaborative efforts

“Collaboration is very helpful. People see different things in different ways and can help give another way a student might perceive something.”

Many of the preservice teachers in our study saw the four-column format as enhancing collaboration. One teacher commented, “I think the last two times (with pairs or small groups) worked well with a four-column design. It works well for communicating ideas to others.” A second teacher, responding to a question about how well collaboration worked while planning, said, “I found when I used the four-column plans, I always found things I wanted to add to it when I shared it with someone.” Both comments indicate that collaborating with a four-column format helped these teachers find concrete ways to improve their lesson plans. As these results show, lesson study and the four-column format may have helped these preservice teachers by encouraging and focusing their collaborative efforts.

## CLOSING THOUGHTS

Lesson study is inherently collaborative in nature, and many of the preservice teachers in our study thought the four-column format enhanced their collaborative planning and revising. Each believed that, because of the lesson study experience, he or she became more student focused in his or her practice. Lesson study naturally leads participants to focus on students’ thoughts, especially during the observation and debriefing stages. Four-column formats may enhance this student-centered focus by requiring participants to craft careful responses to anticipated student thinking during lesson development and thus improve the subsequent observation and debriefing experience.

Becoming student centered and recognizing the value of collaboration are important traits for all teachers, not just preservice teachers, to acquire. We view collaborating and becoming student cen-

tered as on-going, *self-generative* traits—traits that, once learned, generate more learning and can serve teachers throughout their careers (for more on self-generative traits, see Franke et al. [2001]). Lesson study may also allow teachers to develop other traits not explored here, such as reflective dispositions and goal-oriented instruction. Our experiences over the last few years and our research lead us to see lesson study as a worthwhile initial professional development experience for preservice teachers.

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MICHAEL E. MATTHEWS, michaelmatthews@mail.uomaha.edu, CHRISTOPHER S. HLAS, hlascs@uwec.edu, and TERESA M. FINKEN, tfinken@iwc.edu, teach preservice teachers at the University of Nebraska at Omaha, the University of Wisconsin at Eau Claire, and Iowa Wesleyan College in Mount Pleasant, respectively. They are interested in early and later professional development with teachers as well as problem solving. PHOTOGRAPHS BY COLINA



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